

Amendment under 37 CFR § 1.111  
Application No. 10/622,614  
Attorney Docket No. 030877

### **REMARKS**

#### **Objection under 37 CFR 1.83(a)**

The drawings were objected to under 37 CFR 1.83(a).

However, the drawings show the features of the invention specified in the claims. A person of ordinary skill in the art would find the claimed features without undue effort based on the description in the specification. Moreover, although the drawings were objected, the objection did not identify any specific feature which is not shown in the drawings. Thus, the objection was inappropriate and should be withdrawn.

#### **Rejection under 35 USC §112, Second Paragraph**

Claims 1, 12, 24, 26, 28, 31, 34, 37, 42-45 and 49-51 were rejected under 35 USC §112 as being indefinite.

In amended claims 1, 12, 22 and 45, the first pattern of the first interconnection corresponds to the element 58 of FIG. 4B. The second pattern of the first interconnection corresponds to the element 58 of FIG. 4A. The groove-shaped via-hole corresponds to the element 66a of FIG. 4B. The hole-shaped via-hole corresponds to the element 66 of FIG. 4A.

Claim 22 has also been amended according to the Examiner's suggestion. Also, the limitation "a width of the groove-shaped via-hole being 20-140% of a width of the hole-shaped via-hole" also has been added.

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The amendments of claims 34, 37, 42 and 43 clarify the structure of the first and the second insulating films. New claim 52 has been added.

The insulating film structures corresponding to claims 34 and 37 are described in, e.g., page 27, lines 9-18 of the specification of the present application. The insulating film structures corresponding to claims 42 and 52 are described in, e.g., page 51, line 8 to page 52, line 6 of the specification of the present application. The insulating film structures corresponding to claims 42 and 43 are described in, e.g., page 63 lines 1-16 of the specification of the present application.

Thus, the claim rejections under 35 U.S.C. §112 have been overcome.

#### **Claim Rejection under 35 USC §102**

**(1) Claims 22 and 50 were rejected under 35 U.S.C. §102(b) as being anticipated by *Kazuhiro* (JP 2000-269219A).**

Applicant respectfully traverses this rejection.

Claim 22, as amended, recites “an insulating film formed on the substrate with the conducting layer buried in, and including a groove-shaped via-hole formed in a region above the first pattern of the conducting layer and a hole-shaped via-hole formed in a region above the second pattern of the conducting layer, the via-hole having a pattern which is formed along an extending direction of the conducting layer and is bent at a right angle, a width of the groove-shaped via-hole being 20-140% of a width of the hole-shaped via-hole.”

Thus, the semiconductor device of claim 22 has a feature that the device includes a groove-shaped via-hole having a pattern bent at a right angle, a hole-shaped via-hole, a first

buried conductor filled in the groove-shaped via-hole, and a second buried conductor buried in a hole-shaped via-hole, and the width of the groove-shaped via-hole is set to 20-140% of the width of the hole-shaped via-hole.

The pattern size shift of the width of the groove-shaped via-hole at the lithography step tends to be larger than that of the width of the hole-shaped via-hole according to the proximity effect. Even though the widths of the groove-shaped via-hole and the hole-shaped via-hole on the reticle are set to the same value, the finished size of the width of the groove-shaped via-hole becomes larger than the finished size of the width of the hole-shaped via-hole. Especially, the width of the groove-shaped via-hole is more widened at the bent portion. As the result, defective filling of the groove-shaped via-hole takes place, and the crack and/or peeling of the inter-layer insulating film caused by the defective filling occurs (see, e.g., page 14, line 12 to page 19, line 13 of the specification of the present application).

In the present invention, considering the size shift by the proximity effect, the width of the groove-shaped via-hole on the reticle is set so that the finished size of the width of the groove-shaped via-hole becomes the prescribed range as claimed. According to this feature of the present invention, defective filling of the first buried conductor can be prevented, and the cracking and/or peeling of the inter-layer insulating film can be also prevented.

Also, steps on the first buried conductor plug can be reduced so that the steps do not affect the upper interconnection layers and inter-layer insulating layers. Accordingly, defective contact with the upper interconnection layer and the problems taking place in forming films can

be prevented, and, as a result, the semiconductor device can have high water resistance and high interconnection reliability.

As described above, it is important for improving the water resistance and the interconnection reliability that the relationship between the width of the grooved-shaped via-hole and the width of the hole-shaped via-hole is set to the prescribed range as claimed.

On the other hand, *Kazuhiro* discloses in, e.g., FIGS. 1 and 2 the semiconductor device including the contact grooves 23A, 24B and 25B having patterns bent at a right angle, and the conductor walls 2313, 24C and 25C filled respectively in the contact grooves 23A, 24B and 25B. Thus, the semiconductor devices of *Kazuhiro* and the present invention appear to have a common feature that the device includes the groove-shaped via-hole having a pattern bent at a right angle and a buried conductor filled in the groove-shaped via-hole.

However, *Kazuhiro* does not disclose the hole-shaped via-hole, and neither teaches nor suggests the relationship between the width of the groove-shaped via-hole and the width of the hole-shaped via-hole. Thus, even if the hole-shaped via-hole is added to the semiconductor device of *Kazuhiro*, there is no suggestion or motivation to set the relationship, between the width of the groove-shaped via-hole and the width of the hole-shaped via-hole, to the prescribed range as claimed.

For at least these reasons, Claim 22 patentably distinguishes over *Kazuhiro*. Claim 50, depending from claim 22 also patentably distinguishes over *Kazuhiro* for at least the same reasons.

Thus, the 35 U.S.C. §102(b) rejection should be withdrawn.

**(2) Claims 22 and 50 were also rejected under 35 U.S.C. §102(e) as being anticipated by *Kazumi* (JP 2003-086590A).**

Applicant respectfully traverses this rejection.

*Kazumi* discloses in, e.g., FIG. 1 and 2, the semiconductor device including the annular grooves and the annular walls 11, 15, 19, 22 buried in the annular grooves. *Kazumi* also discloses the annular groove 30 and the via-hole 70 formed in the insulating film 18 in, e.g., FIG. 4(a), and the annular wall 19 filled in the annular groove 30 and the via-plug 69 filled in the via-hole 70 in, e.g., FIG. 5(b). Thus, the semiconductor devices of *Kazumi* and the present invention may have a common feature that the device includes the groove-shaped via-hole having a pattern bent in a right direction, the hole-shaped via-hole, the first buried conductor filled in the groove-shaped via-hole, and the second buried conductor filled in the hole-shaped via-hole.

However, *Kazumi* neither teaches nor suggests the relationship between the width of the groove-shaped via-hole and the width of the hole-shaped via-hole.

For at least these reasons, Claims 22 and 50 patentably distinguish over *Kazumi*.

Thus, the 35 U.S.C. §102(e) should be withdrawn.

In view of the aforementioned amendments and accompanying remarks, Applicants submit that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

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If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

**WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP**

A handwritten signature in black ink, appearing to read "Sadao Kinashi", written in a cursive style.

Sadao Kinashi

Attorney for Applicants  
Registration No. 48,075  
Telephone: (202) 822-1100  
Facsimile: (202) 822-1111

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